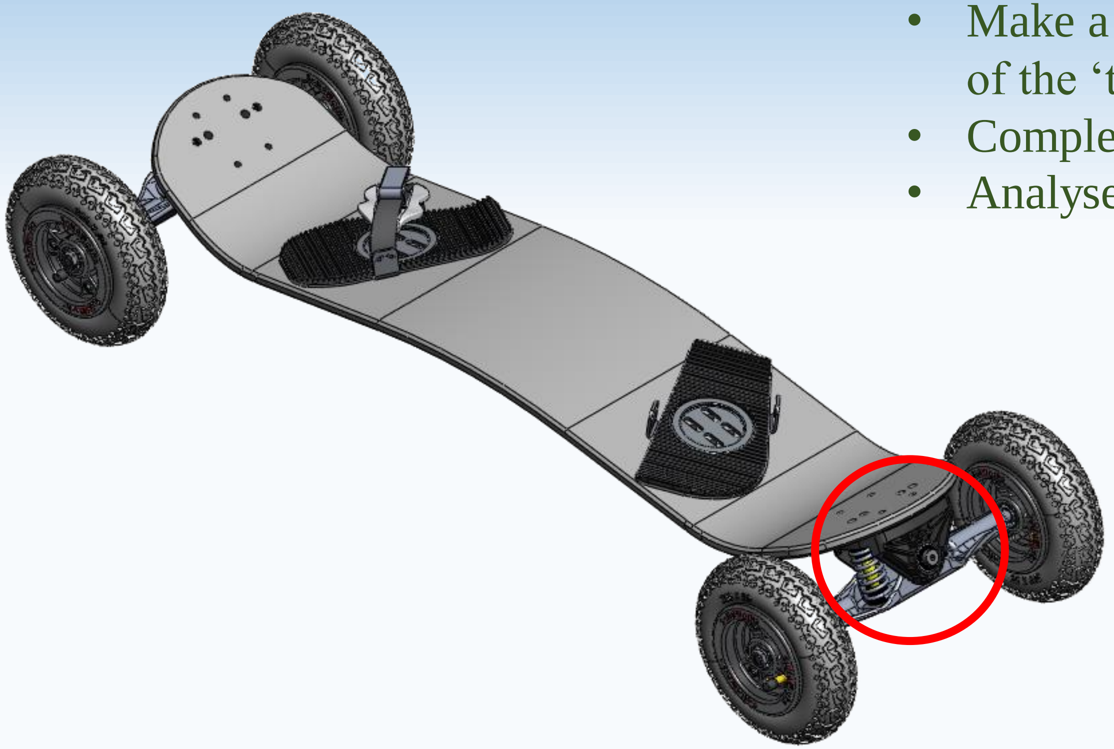
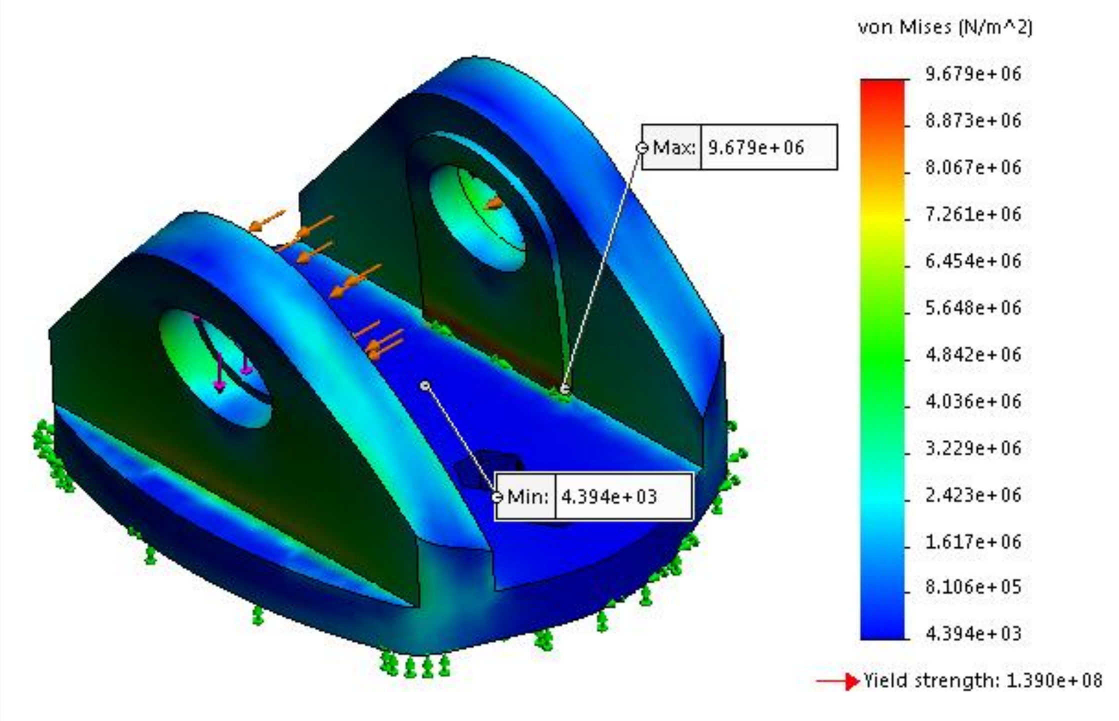
Computer Aided Design (CAD) Stress Analysis SolidWorks Mountainboard Re-Design Project

BEngTech Mechanical Engineering
Bolton St. City Campus TU Dublin



Challenge:

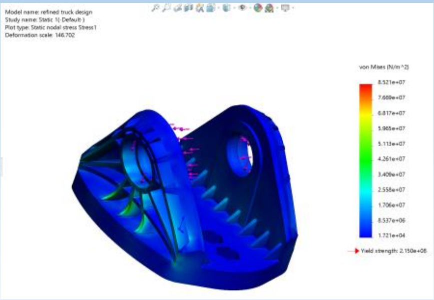
- Make a design change to the truck by updating the material or the shape of the 'truck' part
- Complete an FEA Analysis on the updated part
- Analyse the outcomes



Sample student submission from 2020/21

Material Change from Nylon 6.10 to Alloy 6063-T6

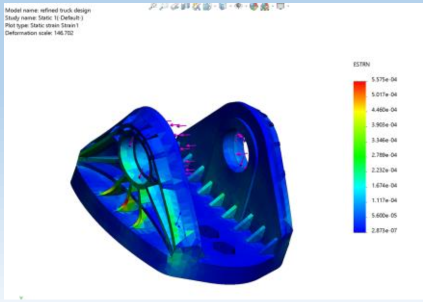
Stress



It is noted that the max stress is 8.521 X10^{7} Pa and the min stress is 1.721 X10^{4} Pa.
In comparison to Nylon 6/10 with a max stress of 8.938 X10^{7} Pa and the min stress is 1.881 X10^{4} Pa.

However, the yield strength for the Alloy is 2.150 X10^{8} Pa, whereas the Nylon is 1.390 X10^{8} Pa. The alloy will be well capable to withstand the expected forces.

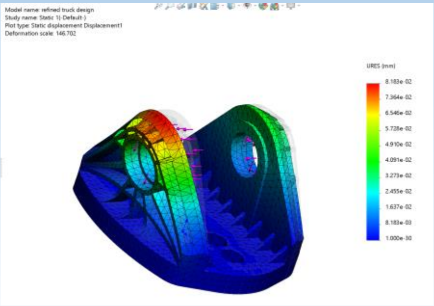
Strain



The max strain for the alloy is 5.574 X10^{-4} ε and the min is 2.873 X10^{-7} ε.
Unlike the Nylon with a max strain of 5.628 X10^{-3} ε and a min of 4.430 X10^{-6} ε.

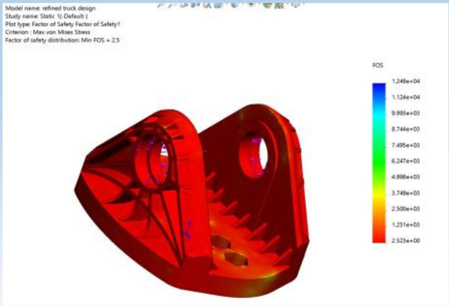
These results show that there will be less strain on the truck by 5.0705 X10^{-3} ε if alloy 6063-T6 is used.

Displacement



The deformation scale on the alloy is 146.702. The max displacement is 8.183 X10^{-2} mm and the min is 1.00 X10^{-30}mm.
The nylon has a deformation scale of 17.5607. it has a max displacement of 7.017 X10^{-1}mm and a min of 1.00 X10^{-30}mm.
It is evident that the alloy has a much smaller displacement.
The alloy displacement is 0.6199mm less than the nylon.

Factor of Safety



The max F.O.S. for the alloy is 1.249 X10^{4} and the min is 2.523.
This is an improvement in comparison to the nylon with a max F.O.S. of 7.390 X10^{3} and a min of 1.556.

The nylon can withstand up to 1.6 times the anticipated loads whereas the alloy can with stand up to 2.5 of its expected loads.
This is a result of the yield strength of the materials. Because the alloy has a higher yield strength of +7.9 X10^{7} Pa, it results in a higher, better F.O.S.

Although the mass of the alloy is 299.293g and the nylon is 155.189g, it also has it's benefits that can overlook the increases is mass. The 6063-T6 Aluminium alloy is much stronger and is less likely to fail. This is represented with the larger factor of safety. Therefore, the component could be slimmed down in order to make it lighter while still offering a better factor of safety than the Nylon 6/10. Because solidworks can only do the analysis on the assumption that the loads will only be static, it is further advised to used this alloy as it will be strong enough to with stand shock loads as well as static loads. This aluminium truck piece would be casted which would be a cost effective way to manufacture it.